

## REMARKS

This response is submitted in response to the Requirement for Information Under 37 C.F.R. § 1.105, mailed December 15, 2009 in the above-identified patent application

### **The Examiner's Requirement**

In the Requirement, the Examiner states that he would like to know information about the origin of the equation beginning "Deviance of  $x_i$ ..." illustrated in claims 6, 11, and 20.

For clarity, Applicants would like to state that they understand the Requirement to be referring to the following equation:

$$\text{Deviance of } x_i = (x_i - \mu_i)/\sigma_i ,$$

where  $\mu_i$  is the mean for  $x_i$  and  $\sigma_i$  is the standard deviation for predictive variable  $x_i$ .

The Examiner continues in the Requirement:

In particular, is the equation an equation known to those of ordinary skill in the art or was the equation invented by Applicants? Similarly, in previous correspondence Applicants have indicated that the described "slope" calculations are not considered to be standard calculations with respect to multivariate equations. Examiner would appreciate any additional information from Applicant regarding the distinctions of Applicants' slope calculations as it relates to a standard slope calculation. Further, Applicant should indicate any other elements of the equations/calculations presented in the claimed invention that Applicant considers to be invented by Applicants.

Requirement at 2.

### **Applicants' Response**

Applicants defined the term "Deviance" and invented the equation

$$\text{Deviance of } x_i = (x_i - \mu_i)/\sigma_i.$$

The Deviance measures how far afield of the mean of that variable's values in the data set in question is a given individual record's value for that variable  $X_i$ , in relation to (or as a multiple/fraction of) the standard deviation of that variable  $X_i$  in the data set. Thus, a given instance of  $X_i$  in a given individual record in an exemplary data set can be, for example, half a standard deviation from the mean (low deviance), or, for example, six standard deviations from the mean (high deviance). In general, a variable that is highly deviant in a particular record will be a major contributor to that record's score as determined by a multivariate scoring function.

Moreover, the slope calculations presented in the Specification relate to the slope (rate of change) of a scoring function  $F(X)$  as only one input variable -- the predictive variable  $X_i$  -- is allowed to vary. This allows one to look at the specific contribution to the function  $F(X)$  supplied by that input variable  $X_i$  while all other variables remain constant. This analysis is an instance of the well known *ceterus paribus* form of analysis. As understood by Applicants, such a slope calculation is not generally made with respect to multivariate equations, such as, for example, scoring equations such as those generated by multivariate statistical analyses as, for example, are described in the Specification. Defining and using such a slope is part of Applicants' insight.

As described by inventor Peter Wu to the Examiner at the personal interview held on September 20, 2007, the motivation for the invention was, in part, as follows: Applicants were searching for a way to quantify the contribution of one or more input variables to a multivariate scoring function  $F(X)$ , such as, for example, the insurance loss ratio scoring equation described in ¶ [0039] of the Specification. They termed this individual contribution of a variable the "**Importance**" of that input variable. This allowed an insurance agent user to explain to, for example, an insurance customer client, why his proposed insurance policy is priced as it is, and

what factors (input variables) are contributing most significantly to the quoted premium (which price is a function of the scoring function).

As is known in the art, and as is described in the Specification, one can measure the change in a multivariable function due to a change in a single variable by calculating the partial derivative with respect to that variable. Specification at ¶ [0028] (“mathematically, such impact is given by the slope of the scoring function with respect to the variable being analyzed. To calculate the slope, the first derivative of the formula with respect to the variable is generated.”)

Using this fact, Applicants devised a two step process: (1) calculate the slope of the predictive variable in question; and (2) multiply the slope by the “Deviance” of that variable to calculate the Importance of that variable. Applicants defined the notion of the “Deviance” and its quantitative expression as provided above.

To calculate the slope is itself not trivial. As Applicants noted, how this should be done depends on whether (i) the slope varies from one data point to another, or whether (ii) the slope is constant from data point to data point in the data set. This attribute will, in turn, depend upon which type of scoring formula is used and how it is generated. As described in the Specification:

For a nonlinear profitability formula such as a neural network formula or a nonlinear regression formula, the slope may be different from one data point (i.e. policyholder) to the next. Therefore, the average of the slope across all of the data points is used as the first criteria to measure Importance.

Since the first derivative can be either positive or negative for each data point and since the impact should be treated equally regardless of the sign of the slope, it is necessary to calculate the average of the first derivative and then take the absolute value of the average.

Specification at ¶¶ [0028-0029].

Thus, for nonlinear scoring formulae, for example, according to Applicants’ invention the absolute value of the average of the slope across all data points in the data set can be used to calculate the Importance of the variable, by using the equation provided at ¶ [0029] of the Specification:

Slope of the Predictive Variable  $x_i = \text{abs} \{ \text{avg} [\partial F(X) / \partial x_i] \}$

where  $F(X)$ , as above, is a scoring function depending upon a number of predictive variables  $X_i$ ,  $i = 1, 2, 3, \text{etc.}$  This equation, and its use in the described context, was also invented by Applicants.

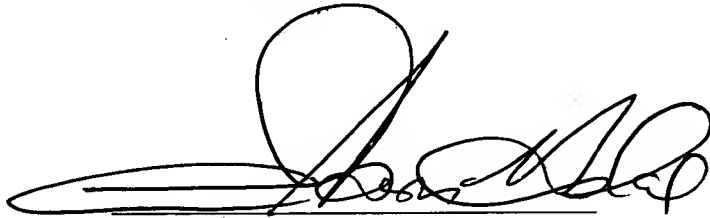
On the other hand, for linear scoring formulae, for example, one can simply use the coefficient of the variable in the scoring function  $F(X)$ , such as, for example, in the equation provided at ¶ [0039] of the Specification, inasmuch as the slope in such a linear formula does not vary from one data point to the next across the data set.

Once having obtained the requisite slope of the predictive variable in question,  $X_i$ , by multiplying said slope with the Deviance one can obtain the Importance, all as defined by Applicants' invention. All of these concepts and their quantitative expression are thus part of Applicants' invention.

No other fees are believed due in connection herewith. Please charge any fee deficiency or credit any overpayment to the undersigned attorneys' Deposit Account No. 50-0540.

Dated: **June 15, 2010**

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Aaron S. Haleva', written over a horizontal line.

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